

## FLOP Counts for Standard Operations on Real Vectors and Matrices

Let:

$\alpha, \beta$  be scalars

$\mathbf{u}, \mathbf{v} \in \mathbb{R}^n, \mathbf{w} \in \mathbb{R}^m$

$\mathbf{A}, \mathbf{C} \in \mathbb{R}^{m \times n}, \mathbf{B} \in \mathbb{R}^{n \times p}$

<u>Operation</u>	<u>Add./Sub.</u>	<u>Mult./Div.</u>	<u>Total</u>	<u>Asymptotic</u>
$\alpha + \beta$	1	0	1	1
$\alpha * \beta$	0	1	1	1
$\mathbf{u} + \mathbf{v}$	$n$	0	$n$	$n$
$\alpha * \mathbf{u}$	0	$n$	$n$	$n$
$\mathbf{v}^T \mathbf{u}$	$n - 1$	$n$	$2n - 1$	$2n$
$\ \mathbf{u}\ $	$n - 1$	$n$	$2n - 1$	$2n^{(1)}$
$\mathbf{u} \mathbf{w}^T$	0	$mn$	$mn$	$mn$
$\mathbf{A}\mathbf{u}$	$m(n - 1)$	$mn$	$2mn - m$	$2mn$
$\mathbf{w}^T \mathbf{A}$	$n(m - 1)$	$mn$	$2mn - n$	$2mn$
$\mathbf{A} + \mathbf{C}$	$mn$	0	$mn$	$mn$
$\mathbf{AB}$	$mp(n - 1)$	$mpn$	$2mpn - mp$	$2mpn$

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(1) - Plus one square root